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Enhancing Motivation in Hybrid Therapy Games for ASD

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Abstract
Hybrid games have been shown to be an effective tool for cognitive-behavioral therapy. We developed the hybrid therapy game *Invasion of the Wrong Planet* and conducted two consecutive studies both with children with and without autistic spectrum disorders (ASD). The studies contrast the design principle of "Encouraged Collaboration" (ECC) with the design principle of "Enforced Collaboration" (EFC). While EFC has been used in recent work on therapy games for ASD, EFC is derived from specific aspects of behavioral therapy. The results show that children across both groups prefer ECC over EFC, while both design principals elicit comparable degrees of collaboration between players. The higher preference may increase motivation and therefore ECC could enhance the effectiveness of games used in behavioral therapy. Latter aim at fostering the social competence and communicative skills of children with ASD.

Author Keywords
Autism; health; behavior therapy; games; hybrid interactive surfaces; CSCW

ACM Classification Keywords
H.5.3. Group and Organization Interfaces: Computer-supported cooperative work.

Introduction
Autism is a developmental disorder. Impairments vary for each individual and can cover a wide range of

Figure 1: Children playing the game. Players have the task to collaboratively defend the earth against alien invaders. They can either attack on their own (player to the left) or work together (players to the right) to be more efficient, thus collaboration is only encouraged and not enforced.

manifestations, which are referred to as "autism spectrum disorders" (ASD). Children with ASD have impairments in social interaction and communicative skills and show stereotyped or repetitive behavior [1]. ASD can be recognized at all levels of intelligence. ASD's are not curable. Intervention strategies focus on decreasing symptoms by improving everyday interactions. In behavioral therapy, positive reinforcement is used in order to train desired behaviors. An easy way to provide this reinforcement is through so called "therapeutic games" or "health games". The effectiveness of such games can be improved by hybrid technology. Games based on such technology are often referred to as "hybrid games", which have the means to blend together digital and analog advantages [9], such as haptic and social elements of analog games and audiovisual possibilities of digital games. This combination of analog and digital advantages can now be used for therapeutic games for children with ASD. Recent studies [4, 6, 12]prove the potential of using hybrid interactive surfaces [7] for therapy games to help in treating HFA and AS. There is reason to assume that players are motivated and feel secure in the digital setting [12]. At the same time, the form factor allows face-to-face communication between the players thereby fostering real-life social interaction. Children with ASD might "benefit from the social computing experience provided by tabletop technology" [12].

The tabletop technology used in those studies was the *DiamondTouch*. Due to this technology in-game actions could be ascribed to the specific player. In this way, cooperation could in certain situations be enforced. This principle is called "Enforced Collaboration" [4] (EFC). In the games used in the aforementioned studies, players always needed to collaborate in order to foster social behavior and communication. The players "were able to attain the game objective [...] only if they play[ed] collaboratively [...]" [6]. This principle of EFC was proven to indeed have a meaningful therapeutic effect. There is however reason to assume that the design principle of EFC can be elaborated further. While enforcing the therapy goal certainly maintains the therapeutic purpose, the game might lack motivation since EFC violates the main principle of a game - the "Voluntary Participation" [11]. Players are forced to cooperate, otherwise they fail. They have no choice on how to best solve the game.

Research indicates that this problem could be solved by applying the design principle of "Encouraged Collaboration" [2] (ECC). According to behavioral therapy, desired behavior should be reinforced and encouraged [3]. Therapeutic games, being instruments of behavioral therapy, should provide the means to encourage collaboration, instead of enforcing it. The players should have the opportunity to participate on a voluntary basis, so ECC "is not so strict as to require users to work together, but it provides some explicit motivation for them to do so in terms of added benefit" [2].

Research and Expected Contribution

We developed a hybrid therapy game to contrast the two design principles of enforced and encouraged collaboration [10] (Figure 1). The design requirements were generated with the help of user surrogates, a therapist as well as a professional children's game developer. The application was later further improved after testing it with normatively developed children of the prospective age. Based on this game we conducted two consecutive studies with 24 children between 7 and 12 years of which 8 had diagnosed ASD.

We presumed that therapeutic effectiveness can be operationalized using two variables; the degree of collaboration and the amount of motivation. Since collaborative games foster social interaction skills [5], it can be argued that the degree of collaboration provides one operationalization of effectiveness. At the same time a preference of a certain design principle is assumed to lead towards higher motivation and therefore implicitly greater long-term therapeutic effectiveness of a game [8]. Measurement of motivation was achieved by comparing the preferences

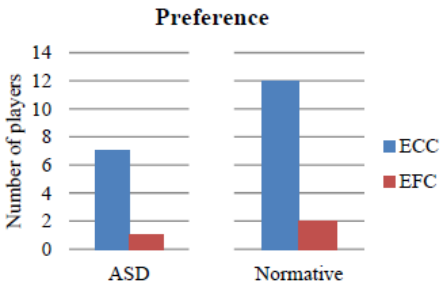

Figure 2: Participants preferred the design principle of ECC to EFC.

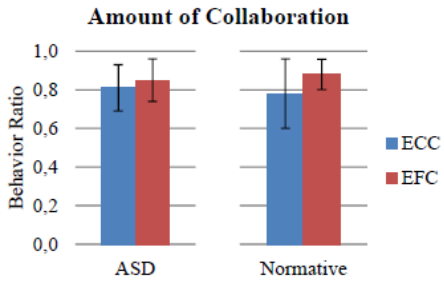

Figure 3: Quantitative measurement of the amount of collaboration. Participants collaborated equally often, when only encouraged to collaborate (ECC) and forced to collaborate (EFC).

of the participants towards the design principles (Figure 2). Collaboration was measured in a quantitative way by generating log data to analyze the participants behavior in the game (Figure 3). As a result of those studies we came to the conclusion that ECC indeed seems to provide a higher therapeutic effectiveness than EFC.

Conclusion and Future Work

Our research inquires into how different design principles may affect motivational aspects and therefore therapeutic effectiveness of hybrid games. It aims at implications for design of hybrid serious games that foster collaborative behavior. According to our findings, ECC is more motivating than EFC, while maintaining the degree of collaboration. This first outcome of our research might offer a change of perspective on the design of therapeutic applications for autism and therefore contribute to the workshop. Although ECC might increase the effectiveness of therapeutic games, we need to further investigate and find evidence for this hypothesis, which we yet could only prove through quantitative analysis. Through the workshop we want to find the best possible approach for conducting a consecutive study on a qualitative basis, e.g. video analyses using established coding schemes. We want to participate in the workshop to elaborate on our evaluation methods to strengthen our findings derived from our quantitative studies.

References

[1] American Psychiatric Association 2000. *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR)*. American Psychiatric Association.

[2] Benford, S. et al. 1999. Designing Storytelling Technologies to Encourage Collaboration Between Young Children. 28, 99 (1999).

[3] Flora, S.R. 2004. *The Power of Reinforcement*. University of New York Press.

[4] Gal, E. et al. 2009. Enhancing social communication of children with high-functioning autism through a co-located interface. *AI & SOCIETY*. 24, 1 (Feb. 2009), 75–84.

[5] Gentile, D. a et al. 2009. The effects of prosocial video games on prosocial behaviors: international evidence from correlational, longitudinal, and experimental studies. *Personality & social psychology bulletin*. 35, 6 (Jun. 2009), 752–63.

[6] Giusti, L. et al. 2011. Dimensions of collaboration on a tabletop interface for children with autism spectrum disorder. *Proceedings of the 2011 annual conference on Human factors in computing systems - CHI '11* (New York, New York, USA, 2011), 3295.

[7] Kirk, D. et al. 2009. Putting the Physical into the Digital: Issues in Designing Hybrid Interactive Surfaces. *In Proc. of BCS-HCI '09* (Swinton, UK, UK, 2009), 35–44.

[8] Koegel, R.L. and Egel, A.L. 1979. Motivating autistic children. *Journal of Abnormal Psychology*. 88, 4 (1979), 418–426.

[9] Magerkurth, C. et al. 2004. Augmenting the Virtual Domain with Physical and Social Elements: Towards a Paradigm Shift in Computer Entertainment Technology. *Computers in Entertainment*. 2, 4 (Oct. 2004), 12.

[10] Marwecki, S. et al. 2013. Encouraging collaboration in hybrid therapy games for autistic children. *In CHI EA '13*. (2013), 469–474.

[11] McGonigal, J. 2011. *Reality is Broken: Why Games Make Us Better and How They Can Change the World*. Penguin Press.

[12] Piper, A.M. et al. 2006. SIDES: A Cooperative Tabletop Computer Game for Social Skills Development. *In Proc. of CSCW '06* (New York, New York, USA, 2006).